



## **Prairie County Tornado Event May 20, 2011 National Weather Service Glasgow Storm Survey Summary**



At approximately 8:27pm on May 20, a tornado struck a ranch 8 miles south of Terry on 10 Mile Road. The tornado was observed by a resident of the house on the ranch. The house itself received no damage, though it was about 150 feet away from observed damage. Significant damage occurred to 4 outbuildings on the ranch. There were no injuries and the horses on the ranch were uninjured as they were out in pasture at the time of the tornado.



Fig. 1. Damage to two barns on ranch. Debris from Old Barn2 is in the foreground and the roof of New Barn is in the background.

## Results From Damage Survey

The NWS conducted a damage survey on the morning of May 22. The ranch residents said they had not moved any of the damage prior to the survey. It had also been raining more or less continuously from the time of the tornado to the time of the survey.

Figure 2 shows a diagram of the buildings on the ranch. Red arrows in Fig. 2 indicate the approximate flow direction implied by debris movement. Names have been assumed for objects in Fig. 2. No damage occurred to the House or the Long Barn.

New Barn and Old Barn2 (seen in Fig. 1) were severely damaged with Old Barn2 completely flattened and debris strewn some distance from the foundation. New Barn was of new construction and had the walls blown out. Some debris was blown downwind to 150 yards westward.

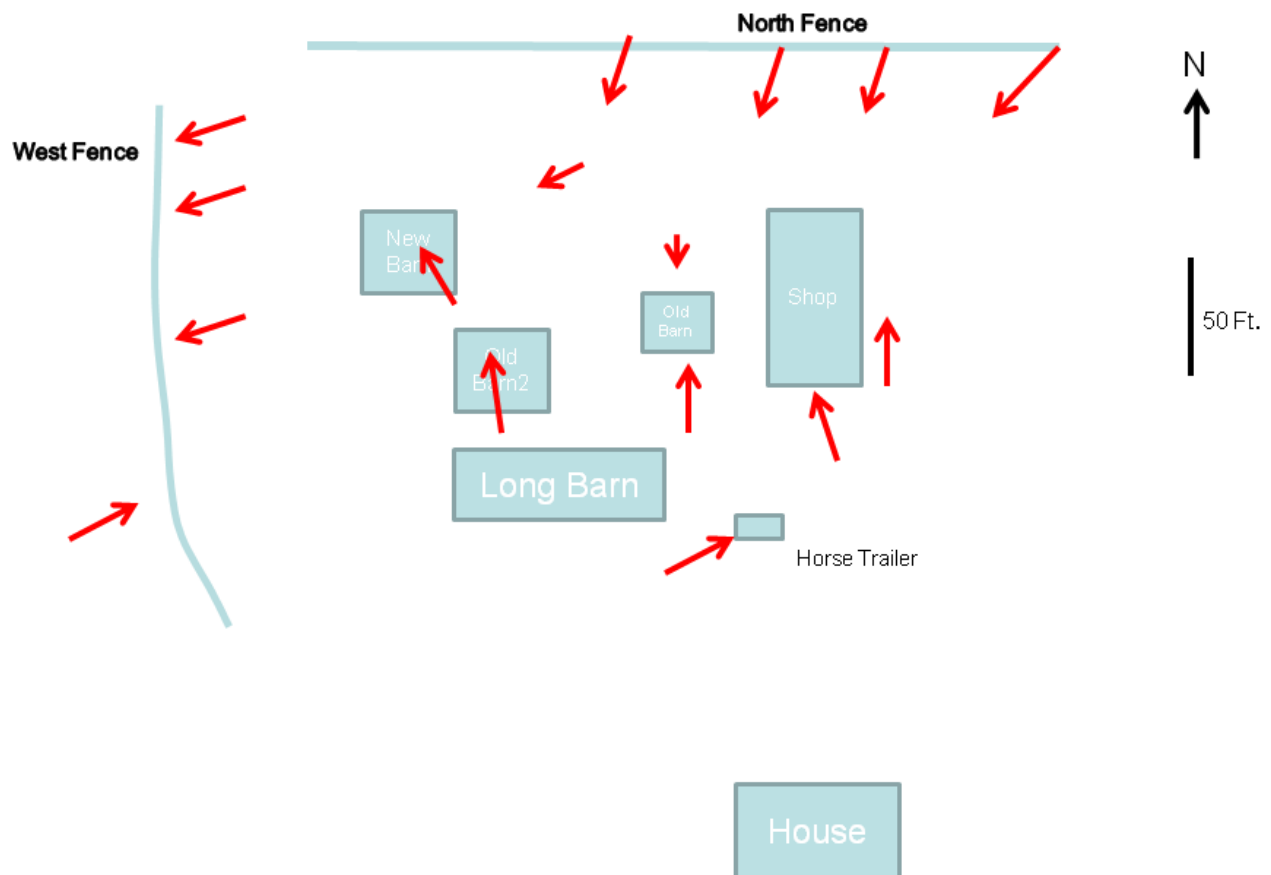


Fig. 2. Overview of Capp ranch. Red arrows indicate approximate direction of damage flow.

Old Barn was completely demolished without much debris movement, though the walls were generally blown inward (Fig. 3). The Horse Trailer was moved about 20 feet to the northeast. A line of trees were toppled just inside the North Fence (Fig. 4). As the ground was saturated from recent heavy rains, the trees were uprooted relatively easily, without any loss of leaves or branches.



Fig. 3. Damage to Old Barn

A larger tree was cleanly snapped northeast of the New Barn location (Fig. 5). Several horizontal sections of the wooden West Fence were blown out (Fig. 6). North sections of the West Fence were blown out westward, while one section of the fence on the south side was blown eastward.

The large front door of the Shop was blown in (Fig. 7) and part of the west wall was blown out. In addition, most of the support beams of the shop were damaged (Fig. 8).



Fig. 4. Line of trees uprooted just south of the North Fence . Photo by John Pisk.



Fig. 5. Tree snapped northeast of the New Barn.



Fig. 6. Damage to West Fence. Near damage was blown westward (right of image), while far damage was blown eastward.



Fig. 7. Damage to Shop with door blown in.



Fig. 8. Damage to Shop showing distorted I-beams.

The convergent and localized damage path, combined with the eyewitness account, confirmed the presence of the tornado. The movement of the Trailer towards the northeast, combined with the southwestward fall of the trees south of the North Fence cannot be explained by any sort of straight line wind event.

A small tree was damaged adjacent to the Shop on the east side, but no other damage was seen to vegetation or fencing east of the Shop. Some debris was scattered up to 100 yards west of the West Fence. From this it was deduced that the damage path was up to 200 feet wide and extended from the east side of the Shop to a short distance past the West Fence. As storm motion on radar was westward, and as debris was scattered downwind west of the West Fence, the damage path ran from the east to the west.

The damage indicative of the highest wind speeds was the collapsed walls of the New Barn and the snapped tree. These are consistent with a rating of EF-1 on the Enhanced Fujita Scale.

## **Radar and Meteorological Data**

House residents noted heavy rain, wind, and thunder around the time of the tornado.

Figure 9 shows the 500mb heights (yellow) and surface MSL pressure (blue) contours at 0200 UTC (8pm local time) from the RUC40 analysis, about 30 minutes before the tornado. This shows a moderately strong midlevel closed low south of Eastern Montana, with a nearly stacked surface low over Southeastern Montana.

Figure 10 shows the 850mb streamlines (blue) from the RUC40 analysis for 8pm plus surface observations (green) and an HPC frontal analysis (brown). The analysis shows a warm front in the northwest sector of the surface low. The location of the tornado is indicated by plotting the letter “I” in white in Prairie County. At the time and location of the tornado, the surface flow was northeasterly on the north side of a strong surface low. Dewpoints were in the mid 50s, with temperatures also in the mid 50s.

Fig. 11 shows the RUC80 sounding analysis for the location of the tornado at 8pm. This shows a very moist and slightly unstable sounding with 532 J/kg of CAPE. Significant wind shear is also present with 60 kts southeasterly at 300 mb and 15 kts northeasterly at the surface. This sounding bears some resemblance to that for hurricane-spawned tornadoes.

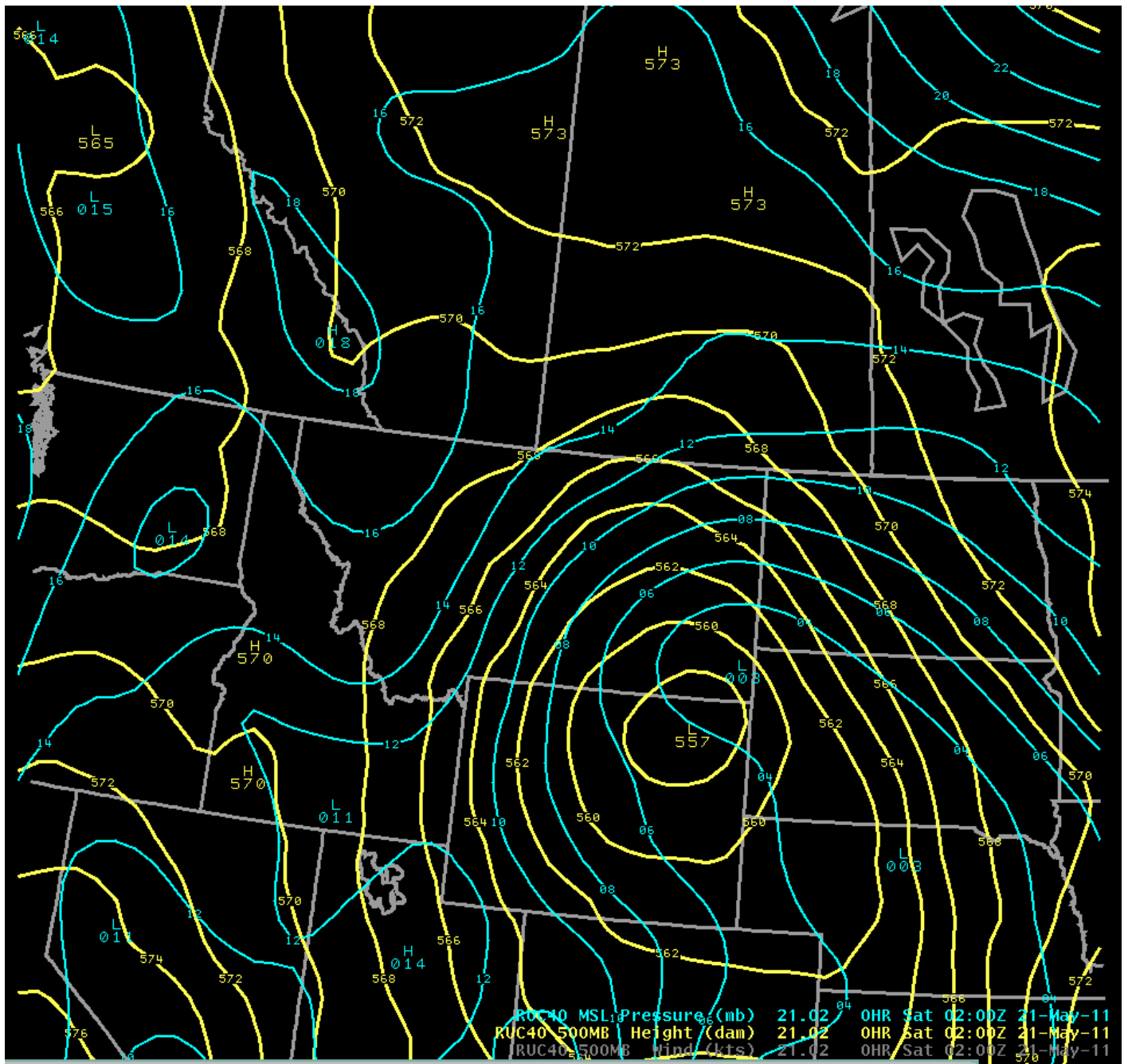


Fig. 9. 500mb heights and MSL Pressure at 2Z (8pm LT) from RUC40 analysis.

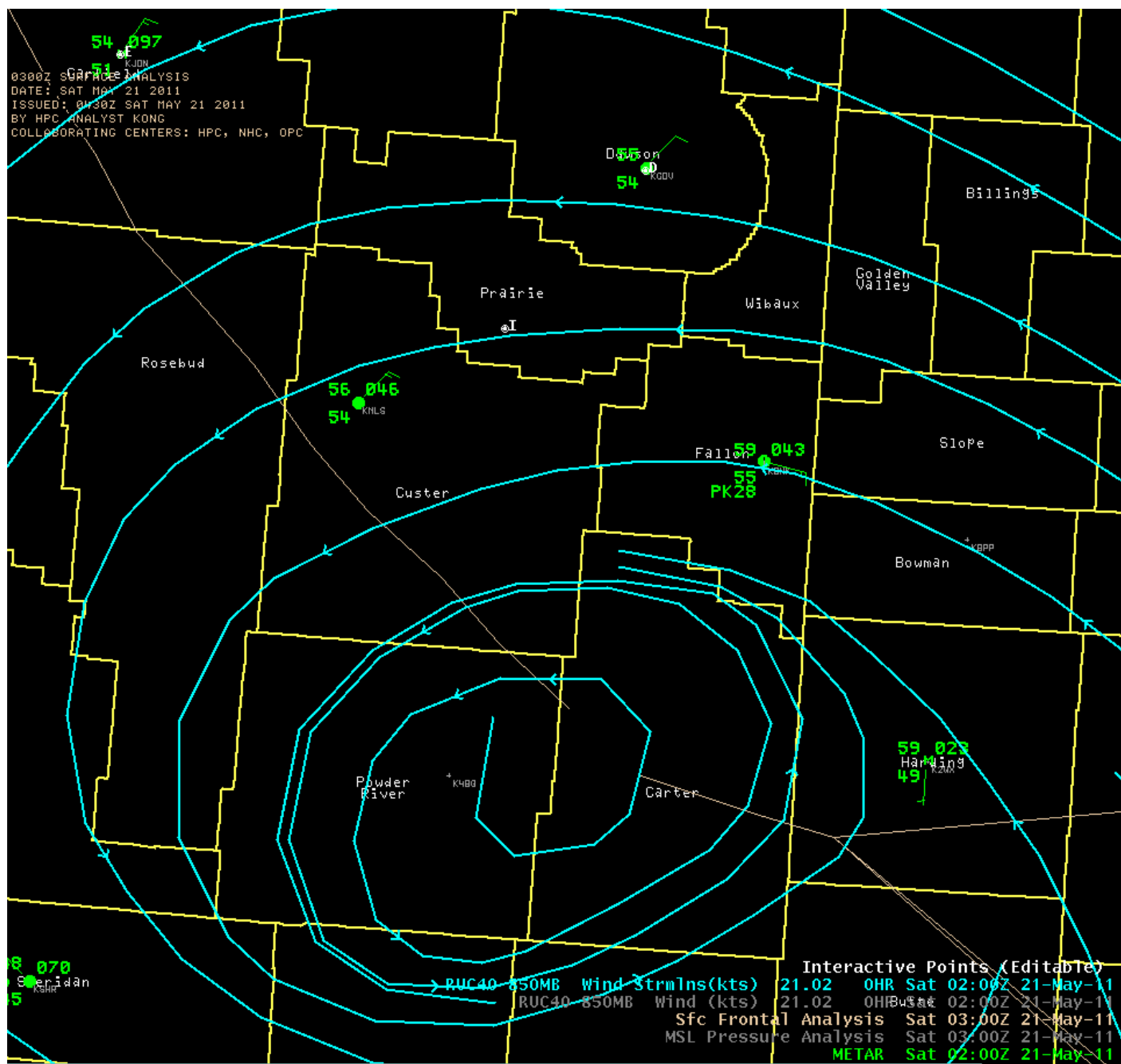


Fig. 10 850mb RUC40 streamlines, surface observations, and HPC frontal analysis for 8pm 5/20/11.

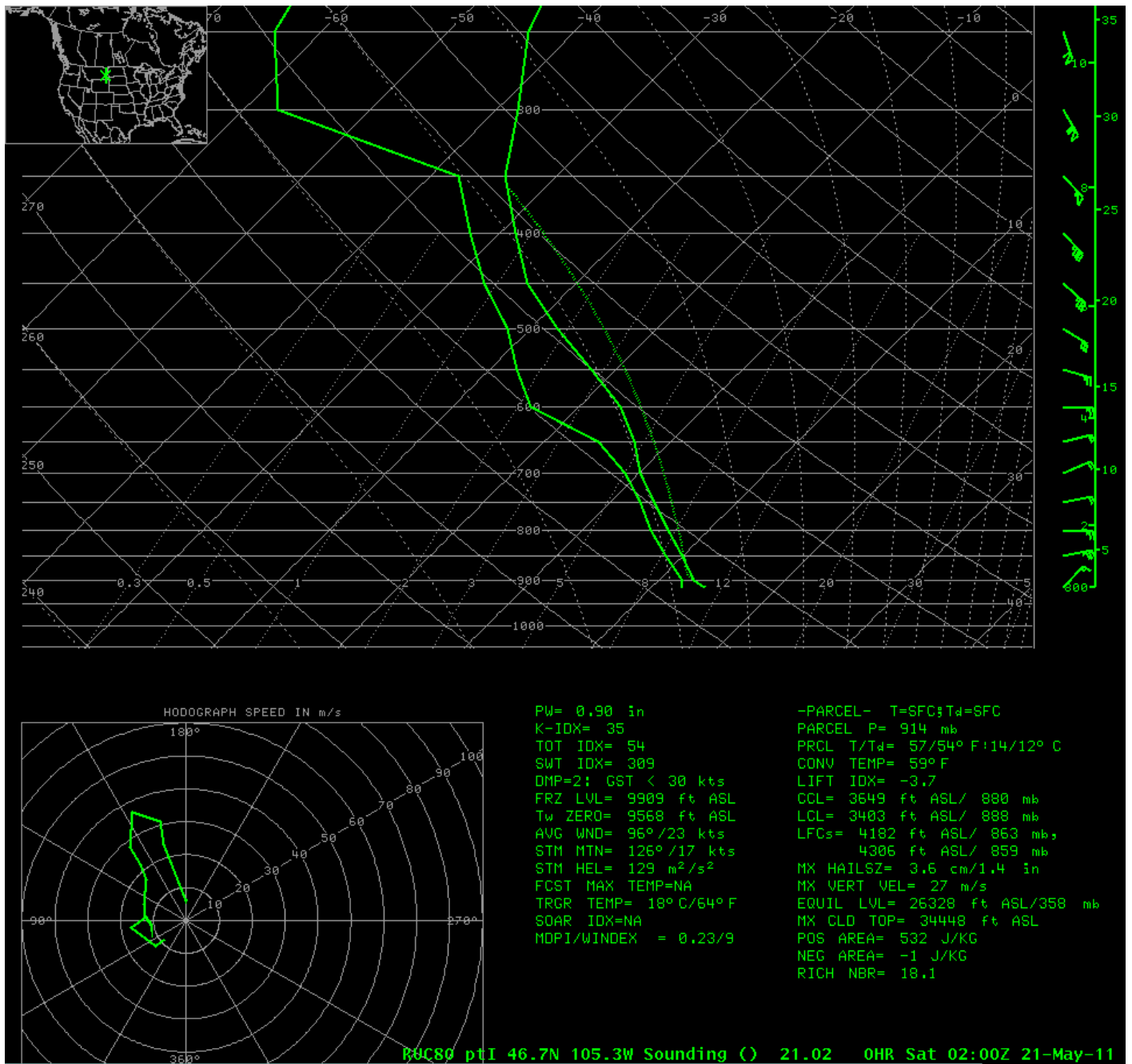


Fig. 11 RUC80 sounding for 8pm 5/20/11 at location of tornado.

Fig. 12 shows the radar data for reflectivity and storm-relative radial velocity from the KGGW radar at 8:25 pm, about the time of the tornado. The tornado was a considerable distance from the KGGW radar, at a range of 122 miles. At this distance, the lowest available radar tilt (0.5 degrees) put the beam 13 000 feet above ground level. Consequently, it was not possible to see most of the structure of the storm with the radar. Still, it is noteworthy that the radar did detect a weak mesoscale circulation exactly over the tornado location at the time of the tornado (white circle in the top of Fig. 12). The velocity couplet of this circulation was about 30 kts. This circulation was present in radar data from about 15 minutes before the tornado to 30 minutes after. It should be noted that such weak circulations are common and are scarcely distinguishable from turbulent eddies. The circulation was not strong enough to trigger the automated mesocyclone detection algorithm, nor any interest from the radar operator.

The reflectivity pattern shown in the lower part of Fig. 12 does not show any cause for concern either. Maximum reflectivity values are modest, with no obvious storm structure. It is noteworthy that a cell that was more intense than the ones over the tornado location was seen on radar about 10 to 20 miles east of the tornado location. This cell collapsed at about the time of the tornado. It is likely that the collapse of this cell was responsible for a separate damaging wind report that was received for 16 miles SE of Terry at the same time as the tornado. One can speculate that the outflow from the collapsing cell may have interacted with the area of weak meso-rotation to generate the tornado. The tornado report and the wind damage report were the only severe reports received in that area all day. That these reports were within 10 miles of each other and at the same time suggests a relation; however, there is no way to know for sure as the radar data is inadequate.

This tornado was undetectable and unwarnable with current radar technology, mostly because of the large distance from the tornado to the radar location combined with the small size of the tornado. Had the radar been closer to the tornado, higher resolution data would have been available, as well as data much closer to the ground. Were that the case, a velocity couplet directly related to the tornado would have been observed.

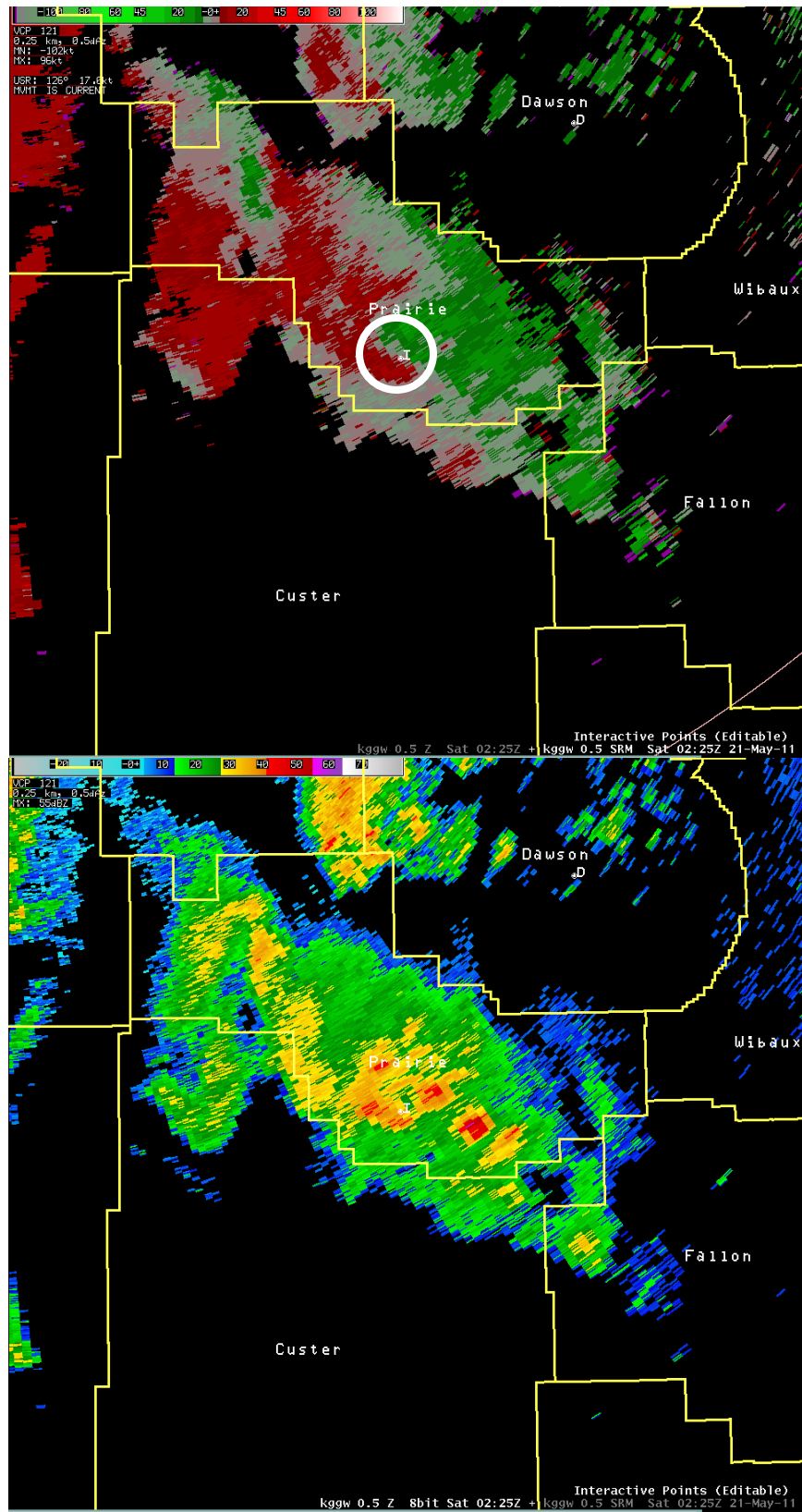


Fig. 12. KGGW radar data from 8:25 LT. SRM (top) and reflectivity (bottom). Weak mesoscale circulation indicated by white circle in SRM plot. Location of tornado indicated by plotted "I".

# Public Information Statement Issued 5/22/2011

PUBLIC INFORMATION STATEMENT  
NATIONAL WEATHER SERVICE GLASGOW MT  
133 PM MDT SUN MAY 22 2011

...FINAL DAMAGE SURVEY RESULTS FOR TORNADO SOUTH OF TERRY MONTANA...

THE FOLLOWING IS A FINAL ASSESSMENT FOR THE DAMAGE THAT OCCURRED 8 MILES SOUTH OF TERRY MONTANA ON 5/20/2011.

- \* EVENT DATE: 5/20/2011
- \* ESTIMATED START TIME: 827 PM MDT
- \* EVENT TYPE: EF1 TORNADO
- \* EVENT LOCATION: 8 MILES SOUTH OF TERRY ON TEN MILE ROAD
- \* PEAK WIND: 90 MPH
- \* AVERAGE PATH WIDTH: 200 FEET
- \* PATH LENGTH: 500 FEET
- \* INJURIES: NONE
- \* FATALITIES: NONE
- \* DISCUSSION/DAMAGE: CONFIRMATION OF A TORNADO WAS BASED ON AN EYE WITNESS ACCOUNT AND A FINDING OF CONVERGENT DAMAGE PATHS. DAMAGE INCLUDED ONE LARGE TREE BEING SNAPPED AND SIGNIFICANT DAMAGE TO TWO SMALL BARNs. A NEWLY CONSTRUCTED BARN HAD COLLAPSED WALLS WITH DEBRIS DEPOSITED TO THE WEST NORTHWEST TO A DISTANCE OF 150 YARDS. ANOTHER SMALL BARN WAS COMPLETELY DESTROYED. THIS DAMAGE WAS CONSISTENT WITH WINDS ABOUT 90 MPH OR THE LOW-END EF1 CATEGORY ON THE ENHANCED FUJITA SCALE. OTHER DAMAGE INCLUDED MULTIPLE TREES UPROOTED AND LARGE BRANCHES TWISTED OFF...A LARGE METAL SHOP DOOR BLOWN IN AND CRUMPLED...THE SIDE OF SHOP BUILDING BLOWN OUT...AND WOODEN FENCING DESTROYED. THE TORNADO WAS BRIEF WITH A SHORT DAMAGE PATH.

FOR REFERENCE...THE ENHANCED FUJITA TORNADO SCALE CLASSIFIES TORNADOES INTO THE FOLLOWING CATEGORIES:

- EF0...WIND SPEEDS 65 TO 85 MPH.
- EF1...WIND SPEEDS 86 TO 110 MPH.
- EF2...WIND SPEEDS 111 TO 135 MPH.
- EF3...WIND SPEEDS 136 TO 165 MPH.
- EF4...WIND SPEEDS 166 TO 200 MPH.
- EF5...WIND SPEEDS GREATER THAN 200 MPH.

MARTIN/MOYER